The period of Neo-Darwinism (1883-1907)

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Exercise 1 (home group, individual work):

Read the following text carefully. Your task is to fill in the missing words and phrases, which you know from your biology lessons. If you need help, you can...

- go back in the text **or**
- read further **or**
- regard the figures carefully.

If you have problems understanding the text, write down your questions!

The term Neo-Darwinism was coined on the occasion of the revolutionary findings of the scientist **August Weismann**. In 1882, August Weismann declared that there is no _____.

August Weismann conducted a spectacular experiment (see fig. 1), in order to test his hypothesis. He repeated the experiment over several generations of mice.

In contrast, Charles Darwin believed in the idea, that acquired traits can be inherited; an idea that was first formulated by Jean-Baptiste de Lamarck around 1800. But how did **August Weismann** explain the findings of his experiments? He did further research. In 1885 he discovered that germ line cells are separated from somatic cells (body cells) very early in the embryonic development. Accordingly, he postulated the division between _____.

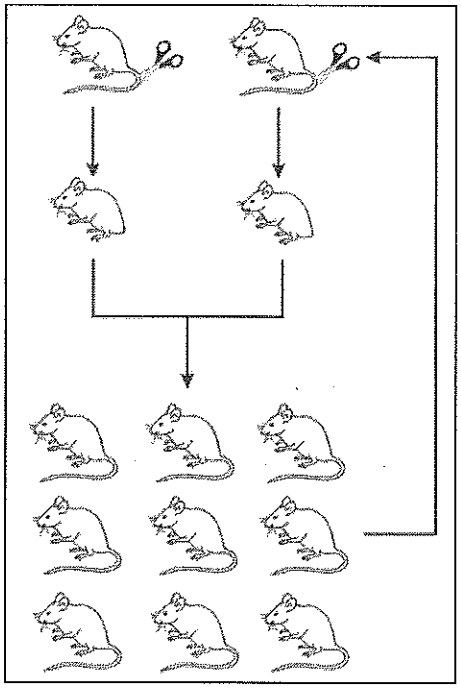

Fig. 1: The procedure of Weismann's experiment. He repeated this experiment 19 times. The offspring of the subsequent matings provided the basis for the next experiment.

But how did Weismann explain variability? He assumed _____ during the sexual reproduction to be the solution. He postulated maternal and paternal genetic material is combined in the form of particles. Figure 2 shows a drawing by August Weismann.

It illustrates how he imagined the process of inheritance. Today we know that the process of inheritance is much more complicated. **August Weismann** had no knowledge of chromosomes and *crossing-over*. However, the scientist recognized correctly, that sexual reproduction is the cause of individual differences, which are the basis for natural selection. Weismann's assumption represented another breach with traditional concepts in 1886. In that time many biologists believed that inheritance works like the coalescence of liquids. According to this idea, sexual reproduction leads to the uniformity in a species, but not to variability.

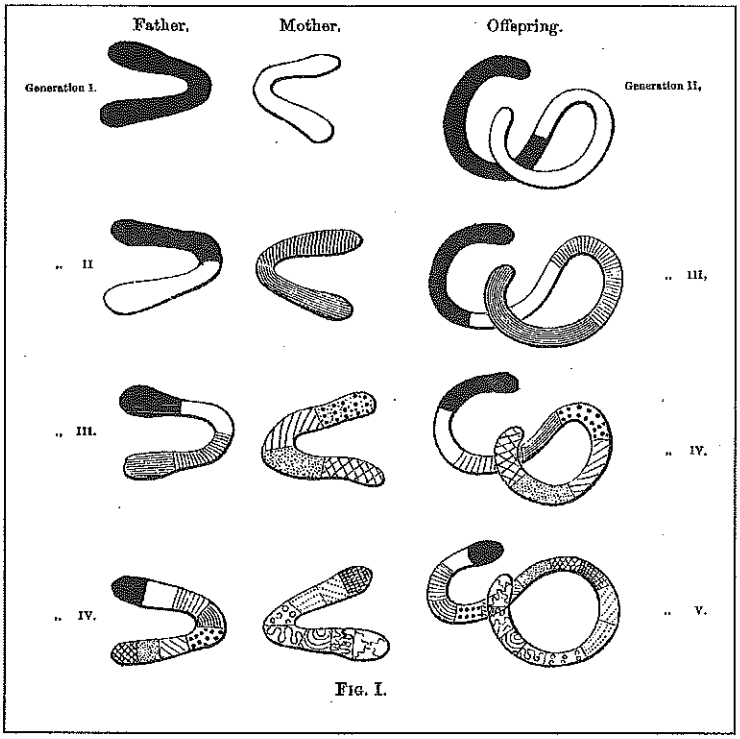

Fig. 2: Original drawing from August Weismann. He supposed that maternal and paternal parts will be inherited as solid particles.
(Fig. from A. Weismann: "Essays upon heredity" Vol. I & II, 1889)

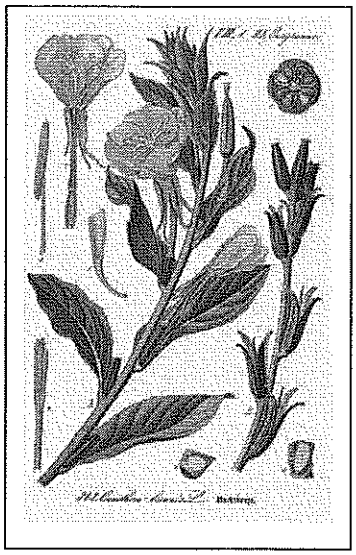

Fig. 3: Evening primrose. De Vries reproduced the Mendelian experiments with this plant.
(Thomé, 1885; Source: www.wikipedia.org)

The scientist **Hugo de Vries** rediscovered Mendel's laws around 1900 and popularized them. Thereby he became the founder of genetics. He reproduced the Mendelian experiments with the evening primrose (fig. 3) and explained the appearance of new variants after crossbreeding with the theory of _____. De Vries felt confident that his discovery of spontaneously occurring modifications in the genetic material – and not natural selection – explained the change of species. The next years Charles Darwin's theory of natural selection receded into the background, while Hugo de Vries' theory was mistaken to be the main mechanism of evolution. Later it became apparent that mutations cannot completely account for evolutionary the change in species, but additional evolutionary mechanisms have to take effect, i.e. natural selection.

In 1896, **Henri Becquerel** discovered radioactivity. This discovery enabled Marie and Pierre Curie in 1902 to determine geological time spans just like using a clock. In 1906 it was possible for the first time to determine the approximate age of the earth by radioactive measurements. They calculated that the earth is _____ years old. This finding surprised many scientists, because most of them estimated the age of the earth to be at the most a few thousand years, whereas Charles Darwins assumptions, however, were confirmed. He would have been very happy about this insight.

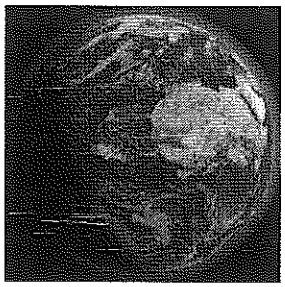

Fig. 4: Our globe.

Exercise 2 (expert group, teamwork)

Check your cloze texts and your reading comprehension for correctness. Subsequently answer the following questions:

a) Describe the process of August Weismann's experiment with mice. What was the finding of his experiment?

b) How does August Weismann explain this result?

c) What causes variability according to the hypothesis August Weismann' formed in 1886? What fact was he not aware of in this time? Discuss the misconceptions of Weismann and explain his misunderstandings about the mechanism of inheritance. Think of meiosis!

d) Why was Hugo de Vries mistaken when he supposed that mutations are solely responsible for the development of new species?

e) Why would Charles Darwin – if he would have been alive at that time – have been very happy about the discovery in 1906? (If you cannot find the solution yet, ask the expert of Darwinism later in the home group.)

Exercise 3 (expert group, individual work)

Copy the terms you filled into the gaps of the cloze text (everything that is underlined) onto the 'milestone-cards' (see last page of the material). There is one card for each milestone from the period of Neo-Darwinism.

Exercise 4 (home group, teamwork):

Each of you is asked to present the milestones of his/her period to the other team members by attaching the milestone-cards chronologically to the time bar. The expert for the period of Darwinism starts. For each milestone-card, the expert explains, which person arrived at which insight by which means and how the insight changed evolutionary theory. Afterwards, the next expert follows until the time bar is completed.

Exercise 5 (home group, teamwork):

After completing the time bar, your team creates a concept map with as many connections as possible.

1.) Choose at least 12 milestones from the time bar (each period should be included).

2.) Write down the term from each milestone on a piece of paper.

3.) Arrange the pieces on a blank sheet so that the milestones which have a close connection lie close to each other. Consider what kind of relationship exists between the different milestones.

The following advices my help you:

The relation between two terms can be that …

… one term is an example of the other term (i.e.: mimicry is an example of natural selection).

… one term is part of the other term in the sense of a whole – part relationship (i.e.: chromosomes contain genes).

… terms are superordinate or subordinate concepts (i.e. mutation and selection are evolutionary factors).

4.) If you are satisfied with the arrangement of the milestones and the relations between them, glue the pieces of paper on the blank sheet.

5.) Now draw arrows between the terms.

6.) Describe the relationship above the arrows.